

COMMUNICATIONS INC.

SERVICE MANUAL

SUBAUDIBLE TONE SQUELCH SYSTEM

MODEL MA-115

NOTE: The following instructions assume that the tone board has been adjusted to the proper CTCSS frequency. If this is not so, carry out the adjustments outlined under the "Tone Frequency Setting Adjustments" section before proceeding.

C. Adjustment Procedure (Setting Tone Modulation Deviation)

- a. Connect the unit to the R.F. Wattmeter or Dummy Load.
- b. Couple an F.M. Modulation Meters' R.F. pick-up to the transmitter.
- c. With the microphone off-hook, key the transmitter.
- d. Adjust the Tone Deviation Control, R618, for ± 0.5 KHz tone deviation.
- e. Apply 0.5 to 1.0 volts RMS at 1 KHz audio to the microphone input.
- f. Adjust the Deviation Control, R216, for ± 5 KHz composite deviation.

D. Adjustment Procedure (Setting Tone Receive Threshold)

With the transceiver in the receive condition, and the microphone hang-up button grounded to the transceiver chassis, inject a signal of appropriate channel frequency into the transceiver antenna jack, and modulate this signal with the wanted CTCSS tone frequency, with a deviation of plus and minus 150 Hz. Then adjust R612 (on the tone board) until the signal just opens the tone squelch system, and allows the receiver audio to function.

After performing this adjustment, check to be sure that the tone squelch will actually open when the tone deviation of the receive signal becomes as much as plus and minus 150 Hz. Further, check to be sure that noise bursts do not come through when the receiver is not receiving any incoming signal.

E. Operation

With the microphone inserted in the hang-up clip, the CTCSS decoder is activated, and the radio will respond only to coded signals. When the microphone is removed from the clip, the decoder is disabled. This allows the operator to monitor the channel and insure that it is clear before transmitting, without any additional manipulation of the radio. When communications are concluded, replacing the microphone in the clip restores the radio to the tone monitor mode.

MA-115 TONE SQUELCH (CTCSS) OPTION

GENERAL DESCRIPTION

The Model MA-115 Tone Squelch system is supplied as a factory installed, or field installed option for BTL-301 and BTL-304 Regency transceivers. This option equips the radio for operation on systems using Continuous Tone Controlled Squelch Systems (CTCSS).

The circuit elements of the MA-115 tone squelch system are mounted on a circuit board module, which fits into the receiver section of the transceiver.

A block diagram of the tone system is shown in Figure 2 and a full schematic is shown in Figure 3.

CIRCUIT DESCRIPTION (Tone Receiving Condition)

Audio from the receiver discriminator is fed into the tone squelch board at terminal L, and passes through the High Pass Filter IC601A, and back to the receiver's audio amplifier circuits at terminal J. The high pass filter removes the CTCSS tones, which are below the normally utilized speech frequencies, so they will not be heard on the receiver loudspeaker.

Audio from the receiver discriminator (At L) is also fed into an active filter, consisting of IC601B, IC602A, and IC602B. This filter is a high Q, bandpass filter, that can be tuned for operation on any of the CTCSS tone frequencies. The components of the filter which determine the operating tone are precision resistors and condensers; R601, R602, R603, R604, R605, R606, R607, C601 and C602.

If the received tone is the proper one, as determined by the bandpass filter, it will be present in the output of IC602 and will be amplified by IC603, and then rectified to a D.C. signal by the tone rectifiers CR601 and CR602. This D.C. signal is then amplified further by the D.C. amplifier, IC603A. The output of IC603 is normally high, and goes to a low voltage upon receipt of proper tone. This output appears at terminal K, which connects to the corresponding terminal K on the receiver chassis, and is used to disable the receiver audio section when no tone is being detected.

TRANSMITTING AND MONITORING CONDITION

Both the block diagram and the full circuit diagram show a terminal point U, which is connected to the hang-up button on the back of the microphone. When the radio is installed, the microphone hanger is connected to the chassis (ground) of the automobile, either by being mounted on a metal portion of the vehicle, or by a suitable wire to the vehicle ground. When the microphone

is in its hanger, point U is grounded; this is the normal "receive" condition of the tone squelch system. Operation of the system in the "receive" condition has been described above.

When the microphone is removed from the hanger, point U becomes ungrounded causing the base of Q601 to go positive. This causes the collector of Q601 to drop to a tenth of a volt or so, causing Q602 to be turned "off," removing the effective short circuit that the collector had been creating across the junction of R624 and R626. With this short removed, a feedback path around the bandpass filter, through IC603A, R626, and C607 created. This causes the bandpass filter to oscillate, at the tone frequency determined by its frequency determining elements. This oscillation output is amplified by IC603B to cause a low voltage at K, just as it would if it were receiving an incoming tone signal, permitting the audio system to operate.

Summarizing the above, when the microphone is off-hook, U is ungrounded, the bandpass filter begins to function as an oscillator, and pin K goes low, allowing the receiver to operate. During the time that the microphone is off-hook, and prior to the time that the microphone has been depressed for transmitting, the receiver will hear any signals on the channel regardless of whether or not they have the proper CTCSS tone. This is the "monitoring" condition of the radio.

The oscillation output of the bandpass filter is fed to F, and thus to the modulation section of the transmitter. When the transmitter is activated by pushing the microphone button, it is modulated by the CTCSS tone.

The amplitude of the tone voltage sent to the transmitter is controlled by R618, which is the control for adjusting the amount of modulation deviation caused by the tone. After the transmitter has been adjusted for proper modulation deviation on speech, according to the instructions given in the transmitter tuning procedure, R618 should be set to provide tone modulation deviation of plus and minus 500 Hz.

TONE SETTING INSTRUCTIONS

The tone frequency is determined by (a) the insertion of jumpers to determine which of three bands of operation is desired, and (b) the adjustment of a precision potentiometer to determine the specific tone frequency.

For purposes of installing the jumpers, the total CTCSS frequency is divided into three bands, the low band being 67.0 Hz to 110.9 Hz; the middle band 114.8 Hz to 192.4 Hz, and the high band 203.5 Hz to 253.0 Hz.

When these boards are shipped from the factory, they are shipped with jumpers in place for operation in the middle band unless a specific frequency has been requested.

INSTALL JUMPERS FOR THE PROPER BAND

Figure 4 shows the jumper locations. Determine which band includes the desired frequency, and insert (or remove) jumpers according to the following chart:

67.0 Hz to 110.9 Hz	Low Band	JU601, JU602, JU603, JU604 are all removed.
114.8 Hz to 192.4 Hz	Middle Band	JU601, JU603 in place. JU602, JU604 removed.
203.5 Hz to 253.0 Hz	High Band	JU602, JU604 in place. JU603, JU605 removed.

After soldering or unsoldering jumpers, at least five minutes should elapse before making any final frequency adjustment. This is necessary to permit the precision resistors and capacitors in the vicinity of the soldering points to stabilize in temperature.

Final frequency adjustment may be made with the tone board installed in the radio, or it may be made prior to installation in the radio. If adjusted outside of the radio, connect a 13.8 VDC source to the tone board, with the positive terminal going to point M and the negative terminal going to point E(gnd). If adjusted inside the radio, put the unit into the "monitor and transmit" condition by lifting the microphone off the hook. Turn the tone output potentiometer R618 fully clockwise and connect the tone measuring equipment to point F. Then carefully adjust precision potentiometer R601 to obtain the wanted tone frequency. Turning R601 clockwise increases frequency.

tone SETTING PRECAUTIONS

Accurate frequency setting is necessary on CTCSS (tone squelch) systems. When making the above frequency adjustments, be sure that you set the tone as precisely as possible. If the tone board is to operate on a system using reed type tone boards, be sure that your frequency setting is within .1 or .2 Hz if possible. Especially on reed tone systems, it is advisable to measure the tone frequency of several of the existing units; it is not safe to assume that the system is really operating on exactly the frequency stamped on the nameplates.

FIG 2 BLOCK DIAGRAM

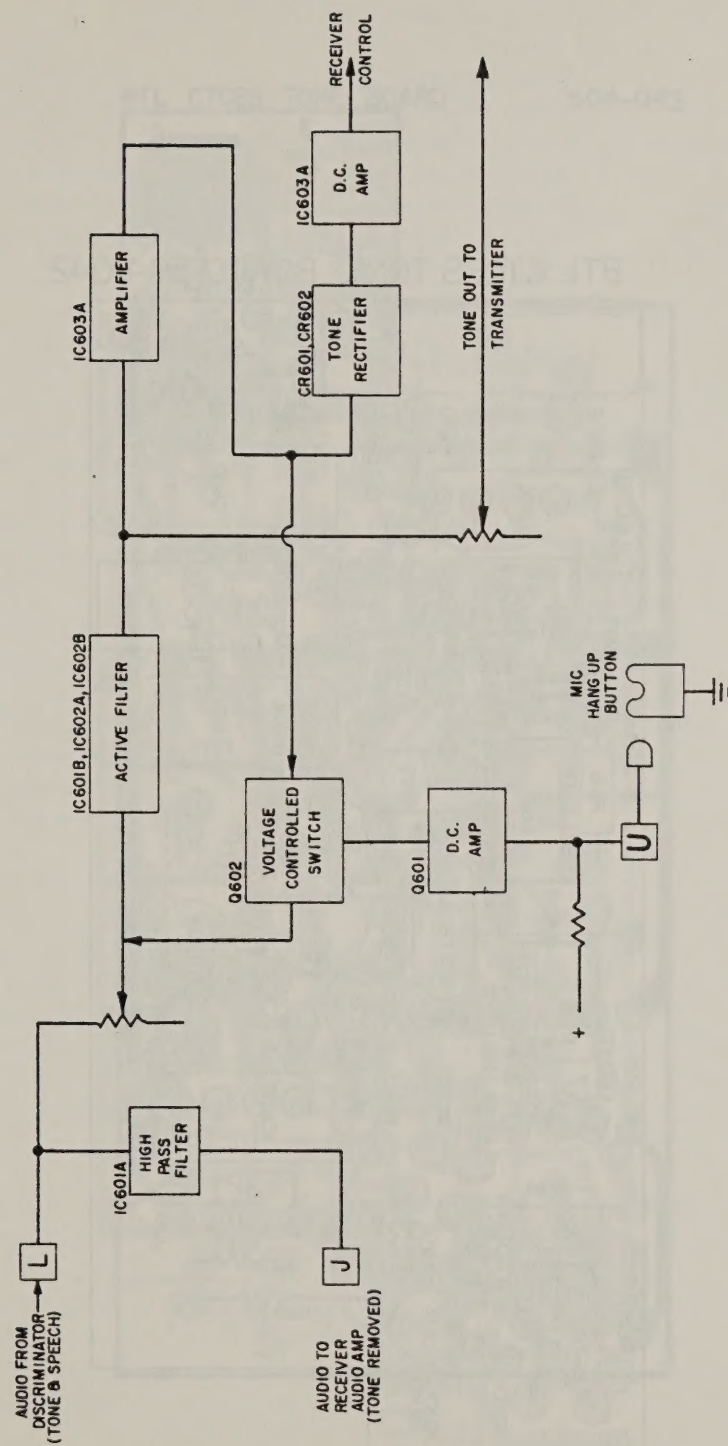
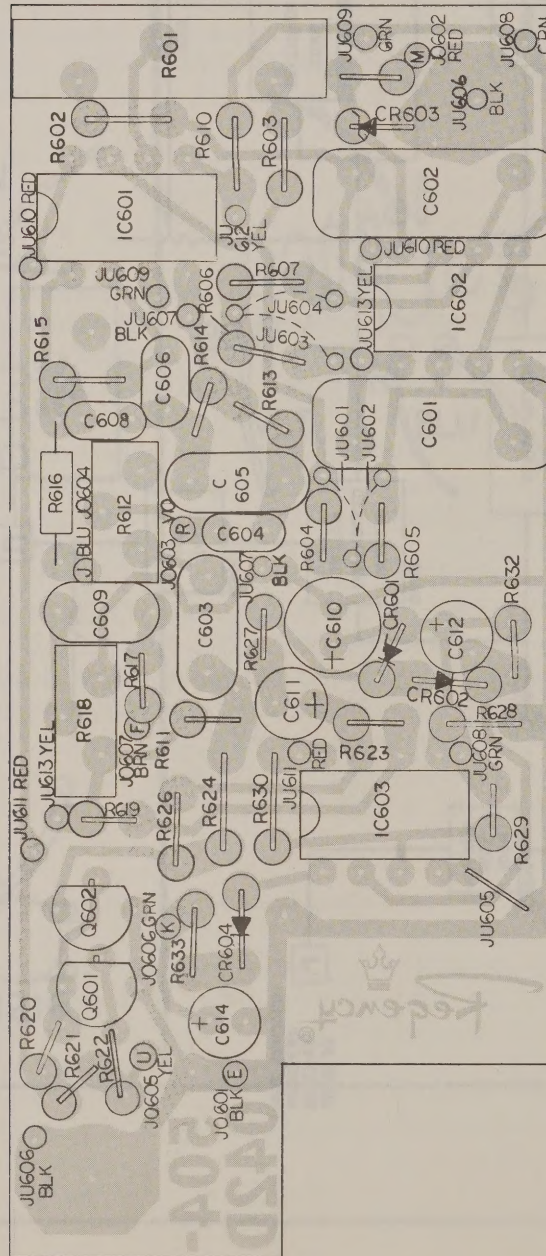


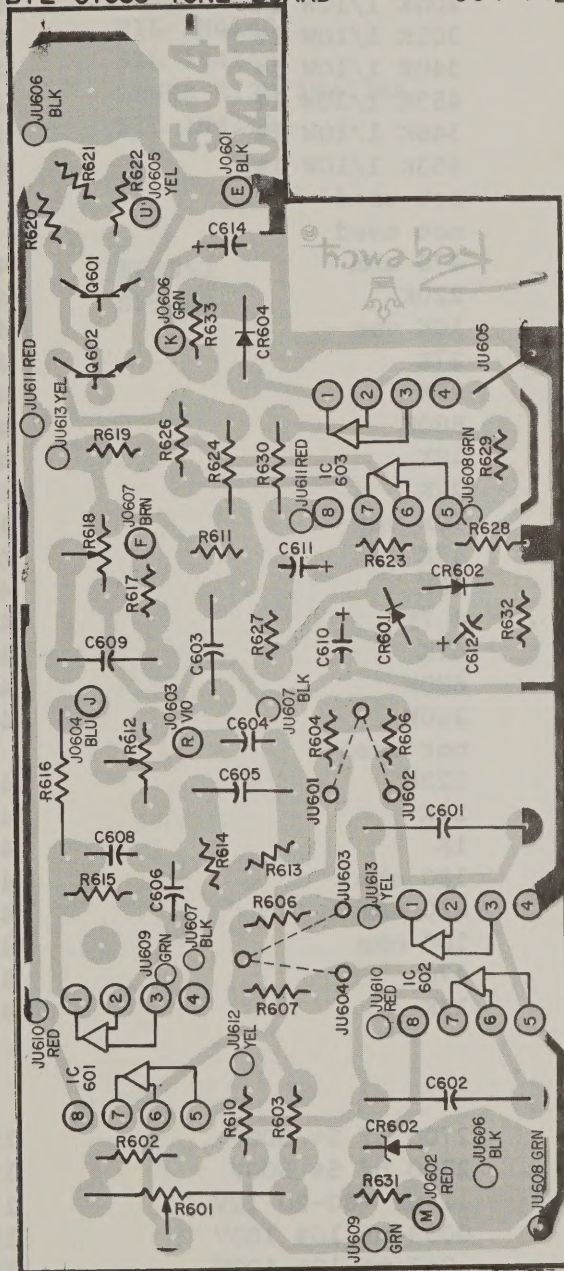
FIG 2 BLOCK DIAGRAM

BTL CTCSS TONE BOARD 504-042



BTL CTCSS TONE BOARD

504-042



MA-115 PARTS LIST

<u>LOCATION</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
<u>RESISTORS</u> (all resistors are $\frac{1}{4}$ W 5% unless otherwise noted)		
R601	200K trimmer	4751-0204-007
R602	200K 1/10W 1%	4709-3402-401
R603	301K 1/10W 1%	4709-3402-402
R604	348K 1/10W 1%	4709-3402-403
R605	453K 1/10W 1%	4709-3402-404
R606	348K 1/10W 1%	4709-3402-403
R607	453K 1/10W 1%	4709-3402-404
R608	not used	
R609	not used	
R610	470 ohm	4704-0471-032
R611	220K	4704-0224-032
R612	10K var	4751-0104-002
R613	27K	4704-0273-032
R614	27K	4704-0273-032
R615	680K	4704-0684-032
R616	18K	4704-0183-032
R617	22K	4704-0223-032
R618	10K var	4751-0103-002
R619	47K	4704-0473-032
R620	10K	4704-0103-032
R621	4.7K	4704-0472-032
R622	47K	4704-0473-032
R623	680K	4704-0684-032
R624	220K	4704-0224-032
R625	not used	
R626	220K	4704-0224-032
R627	22K	4704-0223-032
R628	1K	4704-0102-032
R629	180 ohm	4704-0101-032
R630	820 ohm	4701-0821-032
R631	100 ohm	4704-0101-032
R632	47K	4704-0472-032
R633	15K	4704-0153-032

CAPACITORS

C601	2700 pf 5% 500V	1504-0272-505
C602	2700 pf 5% 500V	1504-0272-505
C603	.1 uf +80-20 12V	1502-0104-006
C604	0033 mf 10% 100V	1508-0332-610
C605	.047 mf 10% 100V	1508-0473-610
C606	.01 mf 10% 100V	1508-0103-610
C607	not used	
C608	.001 mf 10% 100V	1508-0102-610
C609	.1 uf +80-20 12V	1502-0104-006
C610	50 mf 10V	1513-0500-001
C611	1 mf 10V	1513-0010-002
C612	1 mf 10V	1513-0010-002
C613	not used	
C614	10 mf 10V	1513-0100-001

LOCATIONDESCRIPTIONPART NUMBERINTEGRATED CIRCUITS

IC601	TL082	3130-3167-912
IC602	TL082	3130-3167-912
IC603	LM358N	3130-3167-909

DIODES

CR601	SIL 1N4148	4805-1241-200
CR602	SIL 1N4148	4805-1241-200
CR603	ZENER 8.2V 1N4738A	4808-0000-009
CR604	SIL 1N4148	4805-1241-200

TRANSISTORS

Q601	SPS952	4801-0000-010
Q602	SPS952	4801-0000-010

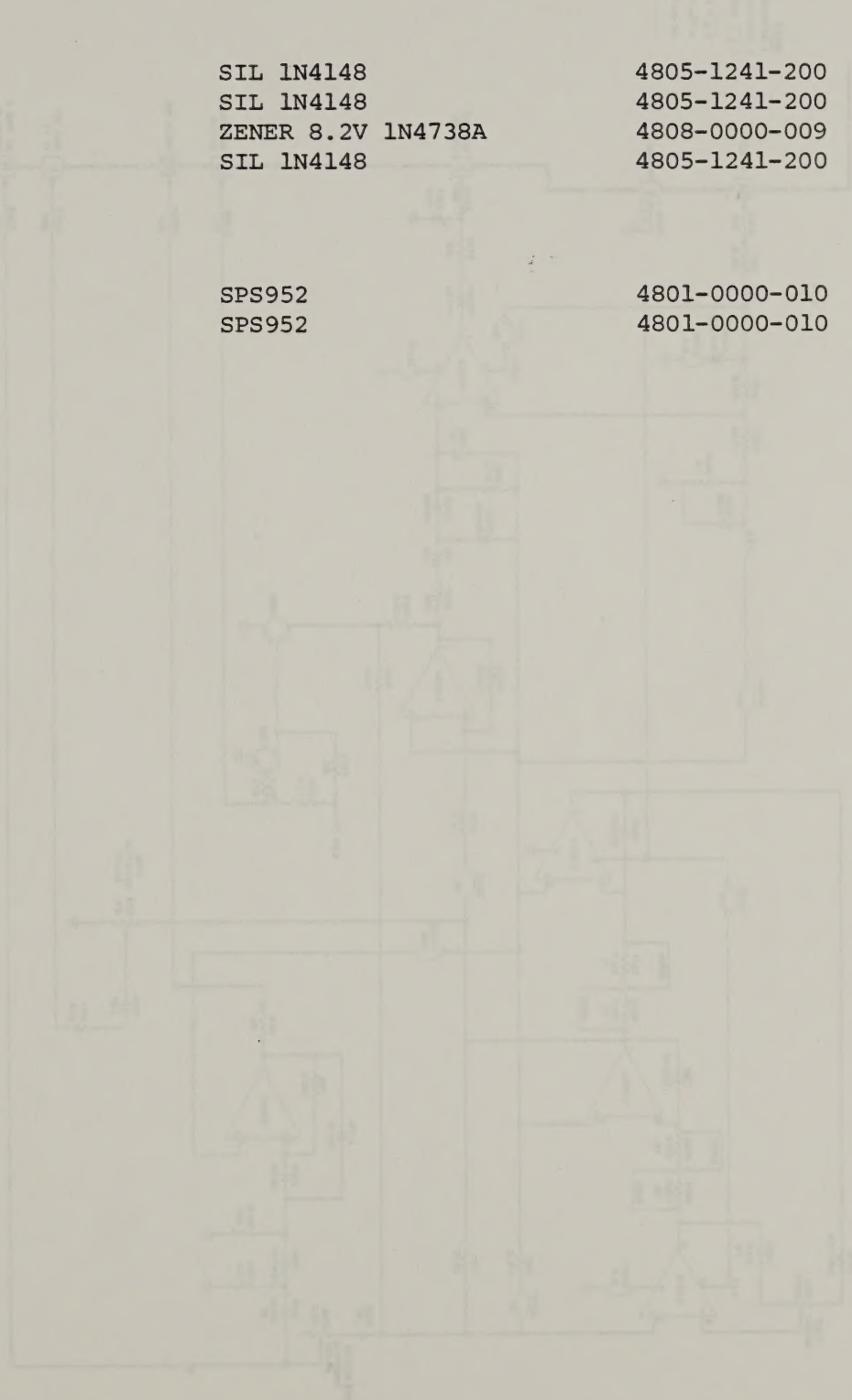


FIG 3 SCHEMATIC



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